

C LEVEL PROBLEMS

1. Hex FAC3 in binary is:

1111 1010 1100 0011

2. Hex FAC3 as an unsigned decimal is:

$$15(16^3) + 10(16^2) + 12(16^1) + 3(16^0) = 61440 + 2560 + 192 + 3 = \underline{64195}$$

3. Hex FAC3 as a signed decimal is:

$$0 * (16^3) + 5(16^2) + 3(16^1) + 13 = -(1280 + 48 + 13) = -1341$$

4. Hex 0064 in binary is:

0000 0000 0110 0100

5. Hex 0064 as an unsigned decimal is:

$$0 + 0 + 6(16) + 4 = \underline{100}$$

6. Hex 0064 as a signed decimal is:

Still 100. None of the most significant bits indicate a change in sign(all 0).

7. Hex 8000 in binary is:

1000 0000 0000 0000

8. Hex 8000 as an unsigned decimal is:

$$8(16^3) = \underline{32768}$$

9. Hex 8000 as a signed decimal is:

1000 0000 0000 0000 MSB negative, so flipped to 0111 1111 1111 1111, added 1 to produce (-)1000 0000 0000 0000, or -32768.

10. Decimal 8000 encoded in 16-bits (unsigned) is in hex:

1F40

11. Decimal 8000 encoded in 16-bits (signed) is in hex:

1F40

12. Decimal -11 encoded in 16-bits (signed) is in hex:

FFF5

13. Decimal -32717 encoded in 16-bits (signed) is in hex:

8033

14. Binary 10111101 in hex is:

BD

15. Binary 1011110100000001 as an unsigned decimal is:

$$2^{15} + 2^{13} + 2^{12} + 2^{11} + 2^{10} + 2^8 + 2^0 = 32768 + 8192 + 4096 + 2048 + 1024 + 1 = \underline{48385}$$

16. Binary 1011110100000001 as a signed decimal is:

$$-(2^{13} + 2^{12} + 2^{11} + 2^{10} + 2^8 + 2^0) = -(8192 + 4096 + 2048 + 1024 + 1) = -15617$$

17. If we had 20-bit registers, the smallest signed decimal integer value would be:

-524288

18. If we had 20-bit registers, the largest signed decimal integer value would be:

$2^{19} - 1$ or 524287.

19. The modular sum of 16-bit hex values 3511 + 4FFC is:

850D

20. The saturated sum of 16-bit hex values 3511 + 4FFC is:

850D

21. The 16-bit operation 0x3511 + 0x4FFC has a carry (Y or N):

No. The most significant place does not result in a value greater than F.

22. The 16-bit operation 0x3511 + 0x4FFC has a overflows (Y or N):

Yes. 3 and 4 signed are positive, but result in an negative number because the most significant bit of 850D is 1.

B LEVEL PROBLEMS

Complete all the C-level problems plus the following:

1. The modular sum of 16-bit hex values 6159 + F702 is:
585B(carry 1)
2. The saturated sum of 16-bit hex values 6159 + F702 is:
FFFF.
3. The 16-bit operation 0x6159 + 0xF702 has a carry (Y or N):
Yes.
4. The 16-bit operation 0x6159 + 0xF702 has a overflows (Y or N):
No.
5. The modular sum of 16-bit hex values EEEE + C00C is:
AEFA(carry 1).
6. The saturated sum of 16-bit hex values EEEE + C00C is:
FFFF.
7. The 16-bit operation 9EEE + AB0C has a carry (Y or N):
Yes.
8. The 16-bit operation 9EEE + AB0C has a overflows (Y or N):
Yes. Adding modularly, this sum results in 49FA, which is positive, whereas the addends are both signed negative numbers.
9. The negation of 16-bit word 0xB00F is:
0x4FF1.
10. The negation of 16-bit word 0x2232 is:
0xDDCE.
11. The negation of 16-bit word 0x8000 is:
0x8000
12. The negation of 32-bit word 0xFFFF329BA is:

0x000CD646

13. 96.03125 as a 32-bit float, in hex is:

0x42c01000

14. -16777216 as a 32-bit float, in hex is:

0xCB800000

15. Hex 43700000, when interpreted as an IEEE-754 pattern, is in decimal:

$11110000 = 128 + 64 + 32 + 16 = 240$

16. Hex C0FF0000, when interpreted as an IEEE-754 pattern, is in decimal:

$111.111 = 7 \cdot (1/2) + (1/4) + (1/8) + (1/16) + (1/32) = -7.96875$

A LEVEL PROBLEMS

Complete all the C-level AND B-level problems plus the following:

1. The largest finite IEEE-754 single precision float, in hex is:

0111 1111 0111 1111 1111 1111 1111 1111 = 7F7FFFFFFF (exponent segment can't be 111 1111 1, results in infinity)

2. The smallest finite IEEE-754 single precision float, in hex is:

1111 1111 0111 1111 1111 1111 1111 1111 = FF7FFFFF

3. The largest nonzero negative IEEE-754 single precision float, in hex is:

1000 0000 0000 0000 0000 0000 0000 0001 = 0x80000001

4. The smallest nonzero positive IEEE-754 single precision float, in hex is:

0000 0000 0000 0000 0000 0000 0000 0001 = 0x00000001

5. -5.125×2^{90} as a 32-bit float, in hex is:

1110 1101 1010 0100 0000 0000 0000 0000 = 0xEDA40000

6. 2^{-138} as a 32-bit float, in hex is:

0111 1010 1000 0000 0000 0000 0000 0000 = 0x7A800000

7. 1.5×2^{-143} as a 32-bit float, in hex is:

1111 1000 0100 0000 0000 0000 0000 0000 = 0xF8400000

8. OPTIONAL — Try this for a challenge, a puzzle, or the experience:
Hex C059000000000000, when interpreted as an IEEE-754 pattern, is in decimal:

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